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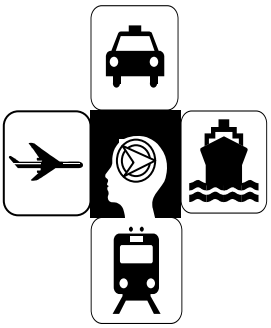

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ASSESS IMPACTS AND BENEFITS OF TRAFFIC SIGNAL PRIORITY FOR BUSES

FHWA-NJ-2004-013 January, 2005

SUMMARY

The objectives of this research were to assess implementation issues associated with the use of bus signal priority in New Jersey, develop operational test plans for implementing signal priority at promising locations, and assess the benefit and costs of signal priority. The research provides a comprehensive and critical review of transit signal priority systems. Potential locations for implementation of signal priority in New Jersey were identified. A simulation study performed on an arterial was used to assess the benefits and determine the operational impacts of signal priority.

INTRODUCTION/BACKGROUND

Bus transportation has traditionally served as the backbone of public transportation. Despite the importance and efficiency of buses, compared to the automobile, these vehicles are weighted equally with automobiles at traffic signals where a bus carrying 50 passengers is treated the same as an auto with a single person. Delays caused by traffic signals and by street traffic congestion increase bus operating costs and degrade transit service quality. One approach to minimizing delays to bus transportation is by implementing bus signal priority. Bus signal priority is an attempt to minimize or eliminate delays to buses at a signalized intersection by temporarily altering the traffic signal phase so that an approaching bus receives a green phase when it arrives. The potential savings in bus travel times can allow buses to maintain its schedule and provide better reliability in travel times.

Although signal priority has proven to be an effective tool for reducing delays to buses, this technique is not always beneficial to the overall traffic network. Providing priority for transit vehicles along a corridor with a large number of transit vehicles can cause a coordinated network to be out of step resulting in an overall increase in delay. Bus

signal priority also has the disadvantage of penalizing the cross-street traffic when high transit volumes exist at the corridor. The objectives of the research was to assess the impacts of and the implementation issues associated with the use of bus signal priority in New Jersey and to assess the benefit and costs of signal priority.

RESEARCH APPROACH

Four primary tasks were performed to accomplish the research objectives. The first task was to conduct a comprehensive and critical review of signal priority studies in the US and abroad. The objective of the literature review was to obtain information on the impact of transit signal priority on delay to transit vehicles, schedule adherence, cross street traffic, pedestrians, overall delay, and accidents. A second task performed in the research was identifying promising locations and develop an operational test plan for implementing signal priority at these locations. To assess the benefits and costs associated with implementing signal priority, the third task was to perform a simulation study of one arterial, Broad Street in Newark. The objective of the simulation study was to delineate procedures for implementing and assessing the implementation of a transit signal priority system in New Jersey. Finally, an operational test plan was developed to assess the benefit and costs of signal priority.

FINDINGS

The effects of implementing bus signal priority on the operation of transit and non-transit vehicles along Broad Street were examined for AM and PM peak hours with existing and future (+10% and +20% traffic growth) traffic volumes. The study found a beneficial impact on both transit and other arterial traffic when transit priority was introduced. There was an expected increase in both bus and auto travel times (relative to the original base) when traffic grows by 10%, without any transit priority. At the same time, there were adverse impacts to the cross streets of Raymond Blvd. and Market Street. However, improvements due to signalization changes equal or exceed those due to transit priority operating with the existing signal timing. As a result of bus travel time reductions, the number of buses servicing the route was determined to be reduced to 9 by slight adjustments to the schedule. The important underlying principle is that for some combinations of these factors ---- notably longer routes, higher bus frequencies, lower bus speeds, and material savings in travel time due to bus priority --- there is an important potential for reducing the number of buses needed to service a route and to reduce operating costs.

CONCLUSIONS

The research demonstrates that bus signal priority can be effective in New Jersey with significant benefits associated with this treatment. The research also demonstrates that bus signal priority may not be appropriate at heavily congested locations or locations serviced by local buses with frequent stops. A successful implementation of signal

priority warrant careful consideration of not only the transit impacts, but the vehicular impacts. Simulation has proved to be a necessary first step in determining the appropriateness of implementing a bus signal priority treatment on an arterial. Although general guidelines can be provided on where signal priority may be effective, each location warrants a separate analysis, similar to the type of analyses performed in this research.

RECOMMENDATIONS

Bus signal priority should be considered in locations in New Jersey that have the greatest potential to achieve the benefits associated with its installation. These benefits include: reduced transit travel times; improved transit schedule reliability; and more reliable transit. Based on the research performed, bus signal priority should be considered at locations with the following factors: a significant portion of the bus delay is at signalized intersections; bus stops are located at the far-side of the intersection; bus volumes are between 10 and 20 buses during the peak hour; express bus service is preferred over local service; all vehicles queued at signalized intersections discharge in one cycle; level-of-Service for the cross-streets is D or better; bunching of buses at bus stop does not occur; pedestrian volumes are low to moderate; and where AVL technology exists or is planned.

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A final report is available online at http://www.state.nj.us/transportation/research/research.html

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